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How we set workplace exposure standards and biological exposure indices

This policy's purpose

This policy explains the role of workplace exposure standards (WES) and biological exposure indices (BEI) produced by WorkSafe New Zealand and sets out the approach we take to managing and developing them. It doesn't cover prescribed exposure standards.

The policy should be read in conjunction with our:

- [work-related health position](#) and
- [workplace exposure standards and biological exposure indices](#)

What are WES and BEI?

Some work processes create harmful dusts, mists, vapours, gases, fumes and fibres that contaminate the air and are hazardous to health. Breathing these airborne contaminants and substances can damage organs and cause diseases such as occupational asthma, bronchitis, silicosis and cancers.

WES

WES represent airborne concentrations of substances in a worker's breathing zone (the area immediately surrounding their nose and mouth). They're intended to indicate a level of exposure to which nearly all healthy adult workers may be exposed without adverse health effects either in the short-term or during a standardised working lifetime.

WES are usually set for single substances but may also be produced for common mixtures in the workplace, such as solvent mixes, oil mists, and fumes from welding or diesel fuel.

WES may be set for:

- longer term, time-weighted average workplace exposure (usually using an 8 hour per day or 40 hours per week work schedule)
- short-term time-weighted average exposure (usually over a 15 minute period of maximum exposure during a single work shift), or
- a ceiling limit concentration (usually instantaneous, which at no time should be exceeded during any part of the work shift).

WES are measured by personal monitoring using procedures that gather air samples in the worker's breathing zone. Assessment of work-related exposure is not a 'one point in time' measurement; the ideal would be to measure the exposure of every worker every working day, year-round (to deal with variability in measurement results, which can arise no matter what is done to keep conditions consistent). As this ideal is not feasible, exposure assessment requires a good sampling strategy and professional interpretation of results.

WES may include advisory notations for a substance. These notations are about such things as whether the substance is a known or suspected carcinogen, may cause skin or respiratory allergic sensitisation, or may involve significant absorption and toxicity through the skin or eyes.

BEI

Exposure to a substance can also be estimated by biological monitoring. BEI represent concentrations of substances (or their breakdown products) in biological samples (such as blood or urine) below which nearly all workers should not experience adverse health effects from exposure to a particular substance.

A BEI value is intended to complement the WES value for airborne concentration of a substance, helping to provide a more complete picture of exposure to the substance in the workplace.

BEI are measured using biological monitoring through regular urine or blood sampling of a worker.

The role of WES and BEI in the health and safety system

WES and BEI are guidelines and primarily health-based values

WES and BEI values serve two important roles in the health and safety system:

1. They provide information for PCBUs and other duty holders about work-related airborne contaminants and substances hazardous to health that need to be eliminated or minimised in the workplace.
2. They're a tool for occupational health professionals – when carrying out exposure assessments, assessing health risks, or assessing the need for or effectiveness of controls in a workplace.

WES and BEI values support exposure monitoring, which informs risk assessment (determining what workers are exposed to and how much) and risk management (deciding what needs to be done to eliminate or reduce workers' exposure) at both the individual workplace level and for New Zealand as a whole.

In doing so, our WES and BEI values have a third important role – they're benchmarks against which to assess how well (or otherwise) New Zealand workplaces are protecting workers and other persons from harm to their health, safety, and wellbeing from work-related airborne contaminants and substances hazardous to health.¹

Our WES and BEI are not:

- mandatory legal limits that must not be exceeded
- a dividing line between safe and unsafe levels of exposure
- a way to protect workers from exposure or a way of eliminating or minimising exposure.

WES and BEI values aren't a target or the outcome PCBUs should be seeking to achieve. PCBUs should aim to achieve a level as far below an exposure standard as is reasonably practicable.²

How we produce WES and BEI

When developing and updating WES and BEI values we evaluate each substance using the latest available scientific data (for example, identification of a substance's hazardous properties, evaluation of toxicokinetics³ and mode of action, adequacy of evidence).

We do this by reviewing reviews conducted by credible sources that have derived an exposure limit for a substance or have classified the substance as a carcinogen.

We carry out or commission a literature review to collate and assess the credible sources' documentation of a substance's evaluation and values they have developed for the substance. The literature review's report will include recommended WES and BEI values (and any notations for a substance) for New Zealand.

Literature review of reviews by credible sources

- Review primary sources where they have classified the substance as a carcinogen.
- Review primary sources where they have derived an exposure limit.
- Note the exposure limit of the substance for the health effect it is meant to protect against.
- Prioritise exposure limit for severity of health effect, for example, if there are two sources with exposure limits for different health effects (irritation versus cancer), choose the exposure limit for cancer.
- Review information that contributed to the exposure limit, for example, was it based on epidemiological data, case studies, animal modelling etc?
- If available, choose the exposure limit based on the robustness and age of the data, for example, epidemiological data > animal modelling and newer studies > older studies.

We technically review and quality assure the draft report of the literature review and produce a version of the 'WES Review' of the substance for public consultation.

Our technical specialists and external occupational health experts will review public submissions and deliberate on the final values for inclusion in the next edition of WorkSafe's Workplace exposure standards and biological exposure indices.

¹ 'A substance, or product containing a substance, that is known or suspected to cause harm to health...' Health and Safety at Work (General Risk and Workplace Management) Regulations 2016, Regulation 3(1).

² WorkSafe, WorkSafe Position Work-related health, February 2019, [worksafe.govt.nz/laws-and-regulations/operational-policy-framework/worksafe-positions/work-related-occupational-health](https://www.worksafe.govt.nz/laws-and-regulations/operational-policy-framework/worksafe-positions/work-related-occupational-health) p. 2.

³ Also called pharmacokinetics; refers to the movement of a substance through the body, including the processes of absorption, distribution, modification, and elimination of the substance. See definitions WorkSafe's *Workplace exposure standards and biological exposure indices*.

A WES review of a substance won't necessarily result in proposals to change a WES or to include a new WES for that substance.

WES process



How we choose credible sources

We consider a source to be credible if their review data meets the following criteria:

- 1 WES and BEI values are health-based**
 - Values are determined without regard to non-scientific policy, socio-economic impact, cost, economic or technical feasibility, or impact on sampling methods.
- 2 WES and BEI values are based on evaluation of appropriate data**
 - Independent scientists and experts carry out their own original scientific evaluation of research findings.
 - Scientific data is sourced from peer-reviewed research and publications and adequate and appropriate studies that are conducted according to international guidelines for toxicological and epidemiological testing of chemicals.
- 3 WES and BEI values are developed through consensus**
 - WES and BEI values are developed through a process that includes peer, stakeholder and public review of the technical content.
- 4 Documentation for WES and BEI values is accessible and explains how values derived**
 - Documentation is publicly or readily available, including its year of publication.
 - Relevant epidemiological and experimental studies are presented and scrutinised, especially key studies that present data on the critical effect for the WES and BEI values, with a reference list for all studies described.
 - Observed health effects for a substance are described, including the establishment of dose-response and dose-effect relationships and points of departure⁴ for each observed effect, with the critical effect identified and justified.
 - Documentation of the evaluation of a substance includes consideration of mutagenic, carcinogenic, teratogenic and allergic/immunological properties.

Our credible sources

Our primary sources for WES and BEI values include (but are not limited to):

- American Conference of Governmental Industrial Hygienists (ACGIH)
- Dutch Expert Committee on Occupational Safety (DECOS), a permanent committee of the Health Council of the Netherlands
- European Commission's Scientific Committee on Occupational Exposure Limits (SCOEL)
- European Chemicals Agency's Risk Assessment Committee (RAC)
- German Research Foundation (Deutsche Forschungsgemeinschaft or DFG)
- Nordic Expert Group (NEG).

Our primary sources for classifying substances as carcinogens include (but are not limited to):

- International Agency for Research on Cancer (IARC)
- U.S. Department of Health and Human Services' National Toxicology Program (NTP).

How we prioritise substances for WES review or new WES

We regularly review and maintain our *Workplace exposure standards and biological exposure indices*. This includes updating a substance's WES and BEI values, adding a substance and WES or BEI values, and removing the WES or BEI values for a substance (for example, if the substance is no longer used in New Zealand workplaces).

We identify and prioritise substances for WES and BEI review, based on the following factors:

- absence of a New Zealand WES or BEI for a substance, for which values have been set by one or more credible sources
- existence of New Zealand WES and BEI values that appear to be significantly out of alignment with more recent values set by one or more credible sources
- time since we last reviewed the substance
- Environmental Protection Authority has received an application for a substance new to New Zealand, a new substance use or a reassessment for a substance where the WES and BEI values have not been reviewed recently

⁴ For example, lowest observed adverse effect level (LOAEL), no observed adverse effect level (NOAEL) etc.

- use and prevalence of the substance in New Zealand workplaces and extent of workplace exposure (if such information is available)
- the substance's human health hazard classification⁵ and nature of exposure risk
- nature and severity of effects of workplace exposure
- extent of any relevant new information or data
- availability and quality of scientific data (for example, epidemiological evidence including reported cases of work-related ill-health, toxicological data, data on exposure)
- the relevant priorities identified in WorkSafe's strategic document.

⁵ For example, carcinogenic, mutagenic, specific target organ toxicity, respiratory or skin sensitiser.